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KAW VALLEY ANTICLINE.

By E. C. WARFEL.

ABOUT 1883, Prof. I. C. White, of the United States Geological Survey, was employed to see if it were possible to determine whether gas and oil deposits might be located from a scientific standpoint. Professor White, in his report upon such investigation, said that after examining all of the great gas and oil wells of western Pennsylvania and West Virginia he found that every one of them was located either directly on or near the line of an anticlinal axis, and which was the origin of the anticlinal theory. He further found that wells drilled in the same region, and not on the anticlines, were found to be void of gas and oil, and usually productive of large quantities of salt water.

To the uninitiated I would say that an anticline is an upward thrust or bulge in the earth's strata from the original horizontal position.

A wide investigation both in reading and in personal observation leads the writer to conclude that wherever water has penetrated the strata neither gas nor oil will be found in the syncline, but only on or near the axis or apex of an anticline, and then only when it is capped in on all sides and there has been no eruption through to the surface; the theory being that the water forces the gas and oil out of the strata until it goes to where it can go no further and then collects and is held up and put under pressure by the water. So if a well-capped anticline is found, and there are layers of shale rock beds or impervious rock above it, one may reasonably look for gas or oil in or near the dome thereof. These uplifts or anticlines need not be very high, as some of those in southeast Kansas and northeast Oklahoma which the writer has personally examined are about forty feet in elevation above their extreme edge and spread out several miles in width and length; but these small ones usually produce only in small strips along the axis, and sometimes when one end of the axis is lower than the other even the lower end of the axis is unproductive. So while one might miss finding gas and oil in an anticline, yet practically it is the only place to start prospecting, as nearly

all the gas and oil fields are so situated, notable exceptions being northeast of Ponca City, Okla., where there was a dry sand and the oil was found in the syncline.

It would appear that at the time of some of the Ozark uplifts in the later geological times a line of bulges or anticlines was formed in a ring clear around the Ozark region at a distance varying from sixty to more than a hundred miles, being closer to the south and southwest than on the north and northeast. Then there appear smaller ones in the region between the great ring and the mountains, and as this great anticlinal ring is where usually the entire Carboniferous age is in place, it forms an ideal condition for the collection and preservation of gas and oil, and on which line or ring are located the Cushing field, Ponca City, Newkirk, Okla., and the Arkansas City, Baxter, Augusta, Elmdale and Wilsey fields, recently developed, and which appear to be only starting; and then the Illinois fields are on the same line. On this ring is located the great Kaw valley anticline, which is particularly under discussion, and appears to be the largest one yet definitely located and of rather an unusual shape; this great ring being composed of domes in two lines running from four to twelve miles apart.

This one is located about forty-five miles west of Topeka and extends across the Kansas river, the extreme edges about twenty miles east and west and about thirty or forty miles northeast and southwest, and it might be compared in shape to a great inverted meat platter, there being a wide outer ring many miles in width, sloping very gradually, while in the middle there is an area about four miles wide and nine miles long that is practically horizontal; and then between this interior portion and the above-mentioned outer rim there is a dip amounting to about 200 to 300 feet to the mile and about two miles wide. There is, however, a dip in the middle of the dome, or the bottom of the dish, thus leaving the highest part in the form of a ring around the edge of the dome, it appearing that the upthrust was so wide that the weight in the middle caused it to settle back to some extent.

This dome was first noted, so far as the writer can learn, by the United States Geological Survey about the year 1853, but no economic value was attached to it at that time, and only within the past few weeks did I learn that it had been so noted.

In about 1910 Dr. J. W. Beede, while working for some private parties, seems to have discovered the southeast edge of this dome, but appears not to have extended his investigations to the west edge, apparently thinking it to be the usual form, having the dip to the east and a monoplane to the west. However, further investigations disclosed the form mentioned.

The elevation is comparatively very great, being as much as 600 feet above the outer edge on the east, as the Burlingame limestone that was found 600 feet deep at McFarland is an out-cropping surface rock across the dome.

In the fall of 1913 a company was formed to prospect this anticline for gas and oil, and practically the entire dome of the anticline was leased and a prospect hole commenced at a point about a half mile south of Zeandale, on the Rock Island railway, and continued to a depth of 955, where granite was claimed to have been encountered. If so, a new discovery was thus made which is now puzzling all the geologists in the country, it being found at about the horizon of the Pleasanton shales. At McFarland, about fourteen miles southeast, a well was drilled by the Rock Island Railway Company to a depth of 2000 feet and penetrated the Cherokee shales only 174 feet, which are probably about 650 feet thick. Counting off the 600 feet of bulge would make the bottom of the Cherokee shales on the anticline 1876 feet deep; and judging from the deep wells at Caney and Iola, it would appear that this so-called granite is at least 3000 feet out of place, and probably much more.

Various reasons for its presence at this horizon have been advanced, one being that an ancient mountain range lies buried along this anticlinal fold, and that the bulge of the dome was caused by a new uplift of the old mountain range. Another and more probable explanation, if it is granite, is that, the uplift being so great, the breaking of the strata at the edges of a steep dip caused the crevices through which the molten matter of the interior of the earth intruded itself in the form of dikes, and that as the holes drilled are directly on the edge of the steep dip to the west, they struck this crevice and penetrated this dike, which is probably in the form of a vast wedge, and may be several hundred feet, even thousands of feet, in depth. It is not likely to be a vast sheet that was run out by some old volcano and spread over the

surface while this horizon was the surface, as in that event it would not have had the pressure commonly considered necessary to the crystallization of granite. The writer is not yet satisfied that it is granite; but whatever it may be, it is something apparently unknown in Kansas before, and it appears that at Elmdale, Kan., it has since been encountered at about the same geological horizon, it there being reached at about 1700 feet from the surface, but the erosion in the Kaw valley and the variation in the thickness of the strata would account for the difference. Another interesting feature of this anticline is that many of the strata, both of shale and limestone, are heavily mineralized, and while the ledges are continuous, yet in many places the texture so changes that they would hardly be recognizable under the general characteristics of the ledge.

One other interesting feature of this is the partial nonconformity of the strata of the carboniferous formations, it being found that on the north side of the river the heavy ledge of the Emporia limestone lies about fifty feet above the lower blue Emporia, and the Burlingame limestone about thirty feet below the Emporia blue, while toward the west of the dome, and on the south side of the river and near the line between sections 27 and 28, these shales thin out and the Burlingame is bulging upward, while the heavy Emporia dips downward, approaching each other to within about twenty feet. This evidently shows a surface shifting during the formative periods of the rocks.

These conditions and the minerals found in the rocks and shales would suggest to me that during all of the formative period of these strata there may have been an under-water vent from the interior of the earth, through which minerals in various forms were thrown out and mixed with the mud and shell deposits, and thus deposited with the regular strata; and that vastly more interesting discoveries are likely to be found in this region than are now made.

Ever since white men settled in this region earthquake shocks of more or less violence have been felt at frequent intervals, varying from slight tremors to violent shocks that threw down chimneys, cracked stone buildings and threw frame buildings from their foundations, and said to be as heavy as the one that wrecked San Francisco. So it may be

that some of the farmers of Waubaunsee and Riley counties are sleeping peacefully over the slumbering vent of some ancient volcano, liable to break forth at any minute and send them and all their possessions heavenward before they are prepared to take that journey, and that an upheaval of a more general nature may be pending that may any day change the peaceful prairies of Kansas into jagged mountains, and Nature thus show that there is a power greater than a Kansan's bank account or a Kansas political pull.